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cites experiments which would stand comparison with those carried out in modern laboratories, especially those tabulated from William Watson's series of 1768, in which it is seen that Jenner did not initiate experimental research upon the subject but rather devised or followed lines already established before him. The most scientific worker in the field was Angelo Gatti of Pisa, who obtained permission to inoculate in Paris by the rational method of puncture and preparation in 1769. Gatti maintained that smallpox is always caused by the introduction into the body of a foreign body, which is in the nature of a specific virus in that it reproduces itself and multiplies, the disease being communicated by contact, inhalation or ingestion. He waxed furious against the senseless practise of weakening the patient by bleeding and purging, adopted Sutton's open-air and hydropathic régime, and offered prizes in real money for any authenticated case of reinfection after inoculation. Such cases he regarded as eruptions from a mixed infection of other exanthems, such as scarlatina or measles, which he also thought capable of transference by inoculation. The main difficulty with variolation was that each inoculated person was a possible "carrier" of the disease, and this occasioned Gatti and his associates considerable trouble in Paris. In the meantime, Tronchin, Tissot, Mead and other eminent physicians were influential in spreading the practise, which became a common preventive measure in America during the Revolutionary War. In 1768, Thomas Dimsdale was invited to St. Petersburg to inoculate Catherine the Great and her son, receiving for his trouble a barony, \$50,000 down, an annuity of \$2,500, \$10,000 for his expenses and handsome gifts of diamonds and furs. Jenner's experiments of 1796-8 soon swept variolation from the field, for the sufficient reason that there was little mortality and no possibility of transference of the disease by the vaccinated person. Variolation was declared a felony by Act of Parliament in 1840.

Dr. Klebs's memoir is well worthy of perusal by all who are interested in the history of preventive inoculation. Its permanent value is that it obviates the boresome necessity of

investigating the huge literature of variolation, covering even the secular memoirs of eighteenth century celebrities. Its engaging style makes it eminently readable, revealing everywhere the spirit of its genial author.

F. H. GARRISON

ARMY MEDICAL MUSEUM

A Primer on Alternating Currents. By W. G. RHODES. Longmans, Green & Company. 1912. Pp. 145.

Although this book, according to the author, is primarily intended for students preparing for the alternating current part of the ordinary grade examination in electrical engineering of the city and guilds of London, it should be useful to those desiring a very brief elementary course on alternating currents and alternating current machinery. The book is primarily adapted to the use of evening classes in technical schools, and is written in such a way that no knowledge of mathematics is required beyond the elements of algebra. In order to avoid the necessity for the students in these classes to possess a multiplicity of books, such simple mathematical relations as are necessary for the development of the subject are proved in the first chapter of the book. For a similar reason, some useful constants and a short table of logarithms are given.

The early chapters of the book are devoted to developing the elementary principles of magnetism, induction and alternating currents. Alternating currents in circuits containing inductance and capacity are briefly considered. The rest of the book deals with transformers, synchronous motors, induction motors and rotary converters. In this part of the book use is made of simple vector diagrams. At the end of the book a few pages are given to the elementary principles underlying transmission of electrical energy and to simple power measurements. The usefulness of the book is increased by the addition of a number of examples with answers which are given at the end of each chapter.

This little book is well adapted for the purpose for which it is intended. One should expect to find in its 145 pages more than a most brief and elementary treatment of the

broad subject of alternating current and alternating current machinery.

RALPH R. LAWRENCE

Alternating Current Machinery. By BARR and ARCHIBALD. The Macmillan Company. 496 pages and 16 plates.

The title of this book is too broad and somewhat misleading as only certain types of alternating current machinery are considered, namely: the transformer, the alternator, and the rotary converter. No mention is made of induction machines or of the synchronous motor. The first chapters are devoted to complex wave forms and their analysis and to the properties of insulating materials used in alternating current machinery. The insulation of transformers and generators is also briefly considered. The remaining chapters deal with the theory and the design of the transformer, the alternator and the rotary converter. Three chapters are devoted to the transformer. Two of these are given up to the consideration of the fundamental principles, construction and vector diagrams, while the third is confined entirely to design. Some examples of different designs are included. Nine of the remaining twelve chapters deal with the alternator. The mechanical construction of alternators, different types of armature windings, harmonics caused by teeth, and the magnetic circuit are discussed in the first of these chapters. Several chapters are devoted to the discussion of armature reaction, voltage regulation and regulation tests. The effect of a sudden short circuit is also considered. The discussion of the losses, efficiency and heating of alternators is also given considerable space. One chapter is devoted to the parallel operation of alternators. The last chapter on alternators, a chapter of about forty pages, deals only with design. Several examples of design are given. The remaining three chapters are confined to the rotary converter and take up the transformation voltage ratio, armature reaction, armature heating and output. Voltage regulation, losses and efficiency, methods of starting and parallel working are discussed. The last chapter of the book deals entirely with the design of converters, and as in the other

chapters on design, examples of the design of several converters are given. It is unfortunate that the author has used clockwise and anti-clockwise directions of rotation indiscriminately on the vector diagrams to indicate a positive direction of rotation. Although an arrow is added to each vector diagram to indicate which direction of rotation has been adopted, the lack of a definite convention in this connection is apt to lead to confusion. The book is in general well arranged and should be a valuable one alike to the student and the engineer.

RALPH R. LAWRENCE

SCIENTIFIC JOURNALS AND ARTICLES

THE opening (January) number of volume 16 of the *Transactions of the American Mathematical Society* contains the following papers:

G. M. Green: "On the theory of curved surfaces, and canonical systems in projective differential geometry."

H. S. White: "The multitude of triad systems on 31 letters."

G. A. Miller: "The ϕ -subgroup of a group."

R. L. Moore: "On a set of postulates which suffice to define a number-plane."

W. C. Graustein: "The equivalence of complex points, planes, lines with respect to real motions and certain other groups of real transformations."

J. E. Rowe: "Invariants of the rational plane quintic curve and of any rational curve of odd order."

M. G. Gaba: "A set of postulates for general projective geometry."

Virgil Snyder and F. R. Sharpe: "Certain quartic surfaces belonging to infinite discontinuous cremonian groups."

Joseph Slepian: "The functions of a complex variable defined by an ordinary differential equation of the first order and the first degree."

Arthur Ranum: "On the differential geometry of ruled surfaces in 4-space and cyclic surfaces in 3-space."

THE February number (Vol. 21, No. 5) of the *Bulletin of the American Mathematical Society* contains: Report of the eighth regular meeting of the Southwestern section, by O.